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Bigeodesics in first-passage percolation

In first-passage percolation, we place i.i.d. continuous weights at the edges of $\mathbb{Z}^2$ and consider the weighted graph metric. A distance minimizing path between points x and y is called a geodesic, and a bigeodesic is a doubly-infinite path whose segments are geodesics. It is a famous conjecture that almost surely, there are no bigeodesics. In the '90s, Licea-Newman showed that, under a curvature assumption on the "asymptotic shape," there are no bigeodesics with one end directed in some deterministic subset D of $[0, 2\pi)$ with countable complement. I will discuss recent work with Jack Hanson in which we show that there are no bigeodesics with one end directed in any deterministic direction, assuming the shape boundary is differentiable. This rules out existence of ground state pairs for the related disordered ferromagnet whose interface has a deterministic direction.